

What is Claimed:

- 1 1. A phased array antenna comprising:
 - 2 a plurality of radiating elements arranged as orthogonal pairs in a
 - 3 herringbone pattern, and
 - 4 each radiating element includes multiple microstrips disposed
 - 5 conformally on a planar substrate.
- 1 2. The antenna of claim 1 wherein
 - 2 each radiating element includes a dipole formed as a pair of dipole
 - 3 microstrips extending from a pair of launch points.
- 1 3. The antenna of claim 2 wherein
 - 2 each dipole microstrip of the pair of dipole microstrips extends
 - 3 between one launch point of the pair of launch points and a top loading microstrip,
 - 4 and
 - 5 the top loading microstrip provides a capacitive load to the dipole.
- 1 4. The antenna of claim 3 wherein
 - 2 the top loading microstrip extends between parallel microstrips for
 - 3 providing an additional capacitive load to the dipole, and

4 the pair of dipole microstrips are oriented substantially parallel and
5 sandwiched between the parallel microstrips.

1 5. The antenna of claim 1 wherein

2 each of the radiating elements is oriented approximately 45 degrees
3 relative to an array scan axis.

1 6. The antenna of claim 1 wherein

2 the multiple microstrips are disposed approximately one-quarter
3 wavelength above a ground plane.

1 7. The antenna of claim 1 wherein

2 the planar substrate is mounted on a composite substrate having a
3 permittivity and permeability matched at a mid-band frequency of operation to
4 achieve an impedance of approximately 377 ohms.

1 8. The antenna of claim 7 wherein

2 the composite substrate is approximately 1/16 of a wavelength in
3 thickness.

1 9. The antenna of claim 7 wherein

2 the composite substrate is formed from a compound having electrical
3 and magnetic properties.

1 10. The antenna of claim 7 wherein
2 the composite substrate includes an effective dielectric constant of
3 approximately 10.

1 11. The antenna of claim 7 wherein
2 the composite substrate is mounted on a dielectric substrate having a
3 dielectric constant value of approximately 98.

1 12. The antenna of claim 11 wherein
2 the dielectric substrate is approximately $3/16$ of a wavelength in
3 thickness.

1 13. The antenna of claim 11 wherein
2 both the dielectric substrate and the composite substrate have an
3 approximate thickness of $1/4$ of a wavelength and yield an approximate thickness
4 reduction ratio of 6.6 to 1.

1 14. The antenna of claim 1 wherein
2 the multiple microstrips are formed by etching the planar substrate.

1 15. The antenna of claim 1 wherein

2 the multiple microstrips are formed by depositing metallic strips on the
3 planar substrate.

1 16. The antenna of claim 1 wherein

2 the multiple microstrips are arranged to form a current sheet for an
3 aperture of the phased array antenna.

1 17. The antenna of claim 1 wherein the radiating elements are
2 arranged to provide mutual coupling to each other to extend operation at a low end
3 of the frequency band.

1 18. The antenna of claim 1 wherein

2 each radiating element is excited by a balanced transmission line.

1 19. The antenna of claim 1 wherein

2 each radiating element is connected to a transmit/receive network for
3 varying the amplitude and phase of a transmitted signal.

1 20. The antenna of claim 19 wherein

2 the transmit/receive network includes a receiver for determining
3 direction and phase of a received signal, and

4 a processor for controlling the amplitude and phase of the transmitted
5 signal based on the direction and phase of the received signal.

1 21. An antenna system comprising:

2 a phased array formed of a plurality of radiating elements arranged in
3 a herringbone pattern, wherein the radiating elements are formed of multiple
4 microstrips disposed conformally on a planar substrate, and

5 a transmit/receive network connected to the radiating elements for
6 varying the amplitude and phase of a transmitted signal.

1 22. The antenna system of claim 21 wherein

2 the transmit/receive network includes a receiver for determining
3 direction and phase of a received signal, and

4 a processor for controlling the amplitude and phase of the transmitted
5 signal based on the direction and phase of the received signal.

1 23. The antenna system of claim 21 wherein

2 the transmit/receive network includes an array of modular transmitters
3 for exciting a corresponding array of the radiating elements.

1 24. A method of making a phased array antenna comprising the
2 steps of:

- 3 (a) conformally forming multiple microstrips on a planar substrate,

4 (b) arranging the multiple microstrips in a herringbone pattern, and

5 (c) placing the multiple microstrips of the planar substrate
6 approximately one quarter of a wavelength above a ground plane.

1 25. The method of claim 24 including the step of:

2 placing a composite substrate and a dielectric substrate between the
3 planar substrate and the ground plane,

4 wherein the composite substrate has an effective dielectric constant of
5 approximately 10 and the dielectric substrate has an effective dielectric constant of
6 approximately 98.

1 26. The method of claim 25 wherein

2 the composite substrate is made approximately $1/16$ of a wavelength
3 in thickness, and

4 the dielectric substrate is made approximately $3/16$ of a wavelength in
5 thickness.